

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification⁶ : D21G 1/02, D21F 1/40</p>	<p>A1</p>	<p>(11) International Publication Number: WO 98/12381</p> <p>(43) International Publication Date: 26 March 1998 (26.03.98)</p>
<p>(21) International Application Number: PCT/FI97/00561</p> <p>(22) International Filing Date: 19 September 1997 (19.09.97)</p> <p>(30) Priority Data: 963710 19 September 1996 (19.09.96) FI 972400 6 June 1997 (06.06.97) FI</p> <p>(71)(72) Applicant and Inventor: JOKINEN, Kai [FI/FI]; Pajulahdentie 4, FIN-37310 Tottijärvi (FI).</p> <p>(74) Agent: NIEMINEN, Taisto; Patenttitoimisto T Nieminen Oy, Kehräsaari B, FIN-33200 Tampere (FI).</p>		<p>(81) Designated States: CA, CN, JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report.</i> <i>With amended claims.</i> <i>In English translation (filed in Finnish).</i></p>
<p>(54) Title: A ROLLER FOR GUIDING MOVABLE WEB</p> <div data-bbox="321 1150 1318 1495" data-label="Image"> </div> <p>(57) Abstract</p> <p>A roll guiding the travel of paper web, especially in a paper machine, at least a portion of whose mantle tube (1) rotates eccentrically with respect to the roll centre line (12) and the mantle is uniform and its material reinforced plastic or similar composite construction and the roll fitted with bearings by means of adjustable cylinder elements (5). The fitting-with-bearings of both mantle tube (1) ends comprises the said cylinder element, like bushing (5), which is non-rotating and on which at a distance from each other there are two bearings (4a, 4b) fitted to rotate the mantle tube (1) and to make the mantle tube curve by bending it and that there is between cylinder element and axle (2) a joint (8, 3) for adjustment of said cylinder element direction with respect to the said axle or the fastening body.</p>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

A ROLLER FOR GUIDING MOVABLE WEB

This method relates to a rotating roll in accordance with the introductory chapter of patent claim 1.

Previously known is a spreader roll used in context with paper machine calenders, by means of which the travel of paper web can be guided. The roll comprises three cylinders side by side, each cylinder individually fitted with bearings on a support axle running through all three of them. However, the farthestmost cylinders are so fitted with the bearings that the outmost bearings can be moved slightly sideward from the centre line of the support axle. By means of this shifting the three-component roll becomes a construction where the midmost roll is rotating totally around the support axle centre line, but the farthestmost rolls can be adjusted into a slightly deflected position, whereby the whole roll axis of rotation is a broken line, but only with a slight change of direction. The bearings used in the farthestmost rolls have been ball bearings and adjustment has been possible in moving another journal box.

A roll of this type adjusted to be curving like a broken line and whose cylinders are of steel, has slots between the adjacent cylinders when the farthestmost rolls have been adjusted. Even though packings are used in the slots, bearing grease easily trickles out from them onto the paper. The metal roll tube also gets heated at the bearings leaving marks on the paper. Further, by this construction a poor impact tensing and spreading the paper web is produced due to clear points of discontinuity. It is explicitly meant to spread the web sideward by the roll before entering the calender by making the roll middle portion to tense the web at the most and the roll edges less tensing. In making the roll of three or more adjacent cylinders, the tensing effect can be produced only as a broken-line-like profile across on which the paper web

moves.

Further known from the GB-publication 1 332 926 and US patent 3,783,481 is a rotating roll fitted with bearings on a curved non-rotating axle. In these solutions it is difficult to install several bearings one after another on a curved axle and it is not possible to adjust the curvature of the axle. A curved axle, as such, is also difficult to manufacture.

With a roll according to this invention a remarkable improvement of the roll profile and adjustability has been achieved and the slots between the elements in a multielement roll have been omitted. The invention is characterized in what is presented in the patent claims.

The objective of the invention is to eliminate the discontinuities from the roll and this is reached in using reinforced plastic as roll material or a similar composite construction, of which a uniform mantle is made fitted from its ends and most suitably also between them with thrust bearings. The proposed material allows rotation around a slightly curved rotation axis. During rotation the mantle is subjected to alternating stress due to continuous bending. Since in used rolls the required deflection is small, for instance in a six meter roll the deflection of the centre at the roll end is appr. 1 cm, by which such a small spreading during roll rotation is produced that it does not exceed the spreading value of 0,1% permitted for the mantle material.

An adjustment carried out with a roll as per this invention is ideal for paper web. For a standard sized roll a curved and continuous profile is produced on the line where the web touches the roll. Furthermore, the roll is light and inexpensive to manufacture. The mantle curvature can be easily adjusted and fitting with bearings is easily done on one straight or on several straight axles.

In the following the invention is disclosed with reference to the enclosed drawing, where

Fig. 1 is a side section of the roll

Fig. 2 is a side section of the roll, second embodiment

Fig. 3 is a side section of the roll, third embodiment

Figure 1 shows roll 1 of composite construction with a mantle tube 1. The mantle is cylindrical with a standard sized diameter. Within the mantle there is an axle 2, known as such, which is not rotated and which is propped in its position. Axle 2 is not moved during adjustment by means of which the outer profile of the roll is altered. The middle portion of the axle has an enlargement in order to improve its sturdiness. Mantle 1 is a uniform tube.

In figure 1, as an example, one end of the roll is illustrated fitted with an adjustable bearing support different from the one in the other roll end. In both ways it is possible to make the rotation centre of the farthestmost bearing deflect from the centre of support axle 2.

In the solution to the left is the end of bushing 5 that supports bearing 4 fitted by a support joint 8 to support axle 2 inside roll 1. Bushing 5 partly extrudes from the roll and by means of adjusting screw 7 the rotation centre of bushing 5 and as well as of bearing 4 is deflected from the support axle centre. The rotation centre of the bearing is on curved line 12 presenting simultaneously the centre line of the bent roll. Bushing 5 must fit firmly in place on axle 2 which means that in addition to adjusting screw 7 bushing 5 must be made immobile by other supporting means as soon as the proper adjustment status has been determined.

The embodiment to the right in figure 1 shows how bushing 5 is fixed on axle 2 by means of ball joint 3. In this case the

rotation of bushing 5 is most suitably prevented by means of adjusting screws 7 running through axle 2.

As per figures 1,2 and 3 mantle 1 of many meters length and supported by four bearings is curved by adjusting the outermost bearing supports into an externally even curvation without any spots of discontinuity. The curvations in practice are so small that a mantle of composite construction can take completely the existing bending stress. During rotation, by each rotation, the mantle must bend twice over a straight line in both directions, i.e. once to the tensile stress state and once to the compression state. The mantle is affected by alternatin stress which, however, may not exceed the permitted spreading value of 0,1%, i.e. the limit given for composite materials.

Figure 2 shows a roll of composite construction with a mantle tube 1. The mantle is cylindrical with a diametre of standard size. Mantle 1 is a uniform tube. The roll construction rests on two firm axles 2a and 2b.

In the embodiment to the left in figure 2 bushing 5 is a bearing solution fastened by joint 8 that includes a fulcrum pin to axle 2a within mantle 1. The pin of joint 8 goes through axle 2a so that its both ends reach bushing 5. There is at end a reinforcing ring 13 with housings for both pin ends. By means of screw 77 bushing 5 can be turned with respect to axle 2a, whereby bearings 4 form a pair of power bending the mantle tube. The rotation centre of bearings 4 is on curved line 12 presenting simultaneously the centre line of the bent mantle.

The attachment of bushing 5 to axle 2 can be improved in using similar extra screws installed beside screw 7. Screws turnable from differing directions from bushing 5 against support axle 2a can be used.

The embodiment to the right in figure 2 shows how bushing 5 is fixed to axle 2b by means of a ball joint 3. In this case the rotation of bushing 5 is most suitably prevented by means of adjusting screws 7 through axle 2b.

In figure 3 bushings 5 are directly fixed to fastenings 14,15,16,17,18 at the roll ends. The fastenings keep the bushings non-rotating but allow turning them around joint 15 in order to bend the mantle. The arrangement is turned activating bracket 16 by means of force F. A proper way is, for instance, to convey screw force T to bracket 16 turning screw 18, whereby bushings 5 also retain their accurately adjusted angle-position when part 14 is locked and made immobile by the screw.

The mantle material is of glass fibre construction or of carbon fibre epoxy composite construction, which makes the mantle light and inexpensive to manufacture. The paper web moving on the mantle rotates the mantle and the tension force of the paper web works as mantle load, the tension force being relatively small, only a few dozens of kiloponds per metre.

PATENT CLAIMS

1. A roll guiding the travel of paper web, especially in a paper machine, at least a portion of whose mantle tube (1) rotates eccentrically with respect to the roll centre line (12) and the mantle is uniform and its material reinforced plastic or similar composite construction and the roll fitted with bearings by means of adjustable cylinder elements (5) for which elements there is as supporting construction an axle (2), (2a) or a fastening body (17), (15), (14) **characterized** in that the fitting-with-bearings of both mantle tube (1) ends comprises the said cylinder element, like bushing (5), which is non-rotating and on which at a distance from each other there are two bearings (4a), (4b) fitted to rotate the mantle tube (1) and to make the mantle tube curve by bending it and that there is between cylinder element (5) and axle (12), (2a) or between cylinder element (5) and fastening body (17) a joint (8), (3), (15) for adjustment of said cylinder element direction with respect to the said axle or the fastening body.

2. A roll according to patent claim 1 **characterized** in that cylinder elements (5) are deflected with respect to another cylinder element within mantle tube (1), like axle (2), using a mechanical adjusting element, for instance screw (7), to carry out deflection.

3. A roll according to patent claim 1 **characterized** in that cylinder elements (5) are deflected with respect to firm axles (2a) reaching from both ends into the roll using a mechanical adjusting element, for instance screw (7), to carry out deflection.

4. A roll according to patent claim 1 **characterized** in that cylinder elements (5) are deflected in supporting the cylinder elements by a supporting structure outside the roll comprising a joint (15) in the firm body (17) for turning the element

(5) and a turning mechanism (16), (18), for instance using screw (18), to carry out deflection of element (5) and fixing the element in the adjusted position.

AMENDED CLAIMS

[received by the International Bureau on 17 February 1998 (17.02.98);
original claim 1 amended; remaining claims unchanged (2 pages)]

1. A roll guiding the travel of paper web, especially in a paper machine, at least a portion of whose mantle tube (1) rotates eccentrically with respect to the roll centre line (12) and the mantle is uniform and its material reinforced plastic or similar composite construction and the roll fitted with bearings by means of adjustable cylinder elements (5) for which elements there is as supporting construction an axle (2), (2a, 2b) or a fastening body (17), (15), (14) and that there is between cylinder element (5) and axle (2), (2a, 2b) or between cylinder element (5) and fastening body (17) a joint (8), (3), (15) for adjustment of said cylinder element direction with respect to said axle or the fastening body characterized in that the fitting-with-bearings of both ends of the mantle tube (1) comprises said cylinder element, like bushing (5), which is non-rotating and on which at a distance from each other there are two bearings (4a), (4b) fitted to rotate the mantle tube (1) and further only by means of said bearings to make the mantle tube curve by bending it.

2. A roll according to patent claim 1 characterized in that cylinder elements (5) are deflected with respect to another cylinder element within mantle tube (1), like axle (2), using a mechanical adjusting element, for instance screw (7), to carry out deflection.

3. A roll according to patent claim 1 characterized in that cylinder elements (5) are deflected with respect to firm axles (2a) reaching from both ends into the roll using a mechanical adjusting element, for instance screw (7), to carry out deflection.

4. A roll according to patent claim 1 characterized in that cylinder elements (5) are deflected in supporting the cylinder elements by a supporting structure outside the roll comprising a joint (15) in the firm body (17) for turning the element

(5) and a turning mechanism (16), (18), for instance using screw (18), to carry out deflection of element (5) and fixing the element in the adjusted position.

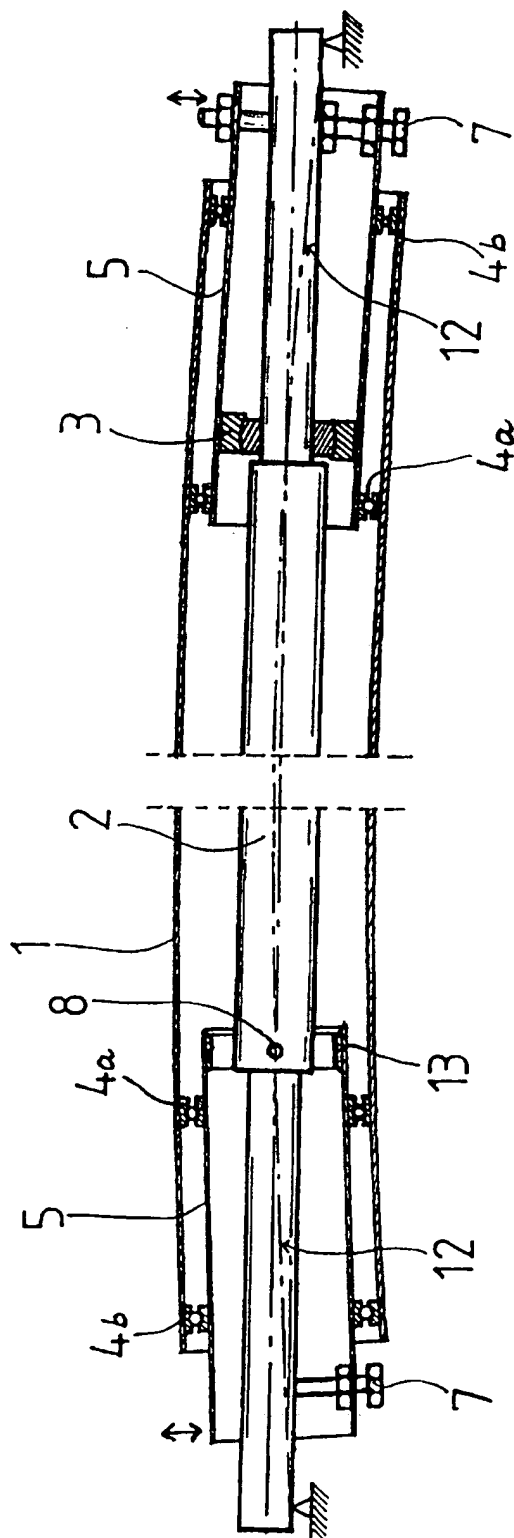


Fig.1

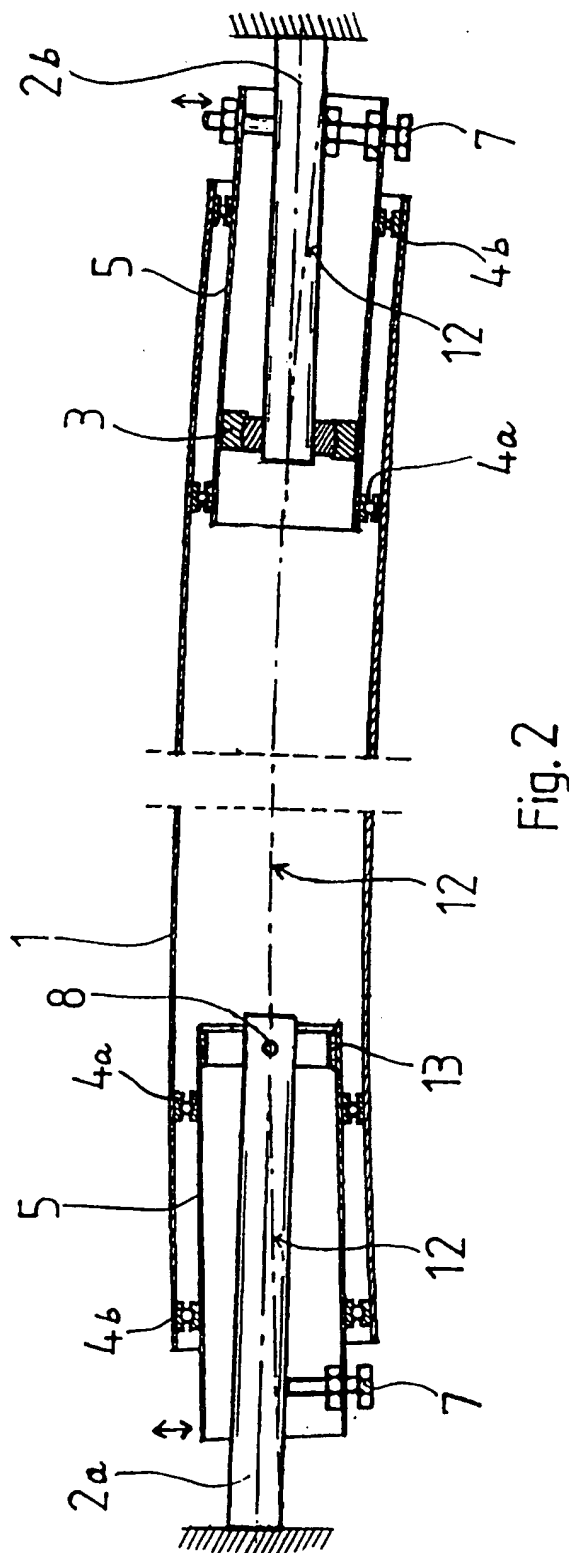
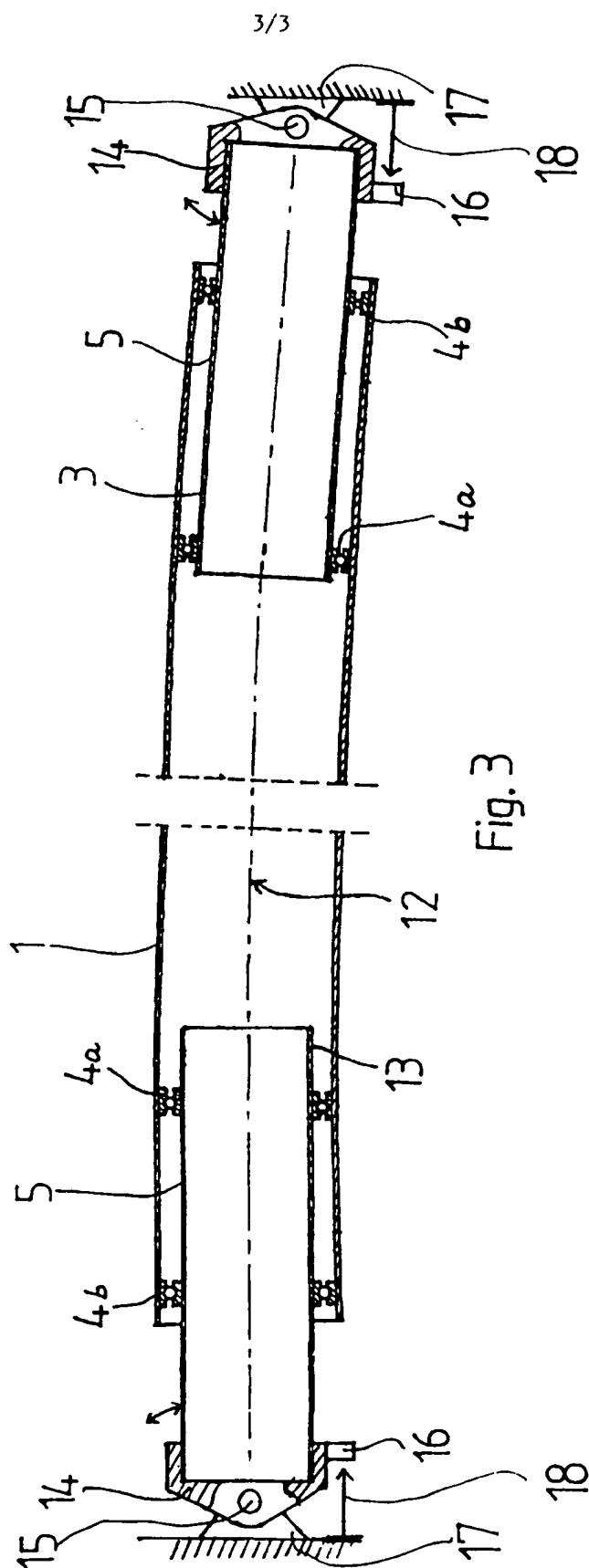


Fig. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00561

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21G 1/02, D21F 1/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F, D21G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4470183 A (HARRI KUOSA), 11 Sept 1984 (11.09.84), column 2, line 45 - column 3, line 17, figure 1, claims 1-5, abstract -- -----	1,2

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *B* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

& document member of the same patent family

Date of the actual completion of the international search

21 January 1998

Date of mailing of the international search report

21.01.98

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Olav Jensen

Telephone No. +46 8 782 25 00

07/01/98

PCT/FI 97/00561

Form PCT/ISA/210 (patent family annex) (July 1992)

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.